# DESCRIPTION

## DISK CARTRIDGE

## TECHNICAL FIELD

[0001] The present invention relates to a disk cartridge for housing a disklike information storage medium such as a magnetic disk or an optical disk.

## BACKGROUND ART

[0002] Recently, disklike information storage media (which will be simply referred to herein as "disks") have been used widely to store computer data and other types of data thereon. Meanwhile, disk drives for recording and/or reproducing information from/on those disks by means of light or magnetism have been developed.

[0003] In the meantime, technologies for increasing the storage capacities of those disks have also been developed. Under the circumstances such as these, higher-capacity, smaller-sized disk drives, which could be built in various mobile devices including disk movie cameras, are now in high

demand. If such disk drives are needed, then the sizes of their compatible disk cartridges should also be reduced.

[0004] In general, a recordable disk is often stored in a disk cartridge to prevent the disk from being soiled with dust or finger marks. Also, the higher the storage capacity of a disk is, the more susceptible to dust or finger marks the disk tends to be. That is why such a disk needs a highly dustproof disk cartridge.

[0005] A typical conventional technology known in this field is disclosed in Patent Document No. 1 and is adopted in Mini Discs (MDs). Specifically, a disk cartridge of that type includes a head window, which partially exposes the disk to allow a record/reproduce head to access it, and a shutter for closing the head window. The shutter is designed so as to slide in the direction in which the disk cartridge is inserted into a disk drive, and includes a locking member for locking the shutter closed.

[0006] This shutter has a U-cross section with a substantially rectangular bottom and holds the body of the disk cartridge between it. The cartridge body has an engaging

groove extending in the inserting direction. And a stopper projection provided for the shutter gets engaged with the engaging groove, thereby sliding the shutter in the inserting direction without dropping the shutter from the body.

[0007] The locking member is located deeper in the inserting direction than the head window is. To unlock the locking member, an opener tab is fixed on an inner side surface of a cartridge holder of a disk drive. To load the disk cartridge into the disk drive, first, the disk cartridge is inserted into the holder, when the opener tab moves inside a groove on a side surface of the disk cartridge, thereby pushing and unlocking the locking member. After that, the opener tab gets engaged with the shutter to open the shutter while the disk cartridge is being inserted deeper. When the disk cartridge is fully inserted, the head window will be opened, too.

[0008] When the disk cartridge is removed from the disk drive, the opener tab cannot close the shutter by itself. For that reason, a leaf spring is arranged on the inner side surface of the cartridge holder and gets engaged with a hole

on the side surface of the shutter. If the disk cartridge is ejected from the cartridge holder while the leaf spring is holding the shutter, the shutter will close the head window.

[0009] As can be seen, the shutter driving mechanism of the disk cartridge disclosed in Patent Document No. 1 has such a simple structure as to contribute particularly effectively to realizing small-sized disks among other things.

[0010] On the other hand, Patent Document No. 2 discloses a disk cartridge that has a structure for applying elastic force to a shutter in its closing direction and thereby preventing the shutter from opening accidentally due to the impact caused by drop, for example. The disk cartridge includes a spring for applying elastic force to the shutter in its closing direction and a holding recess to get engaged with a gripping member provided for a disk drive. When the disk cartridge is loaded or unloaded, the gripping member of the disk drive holds the disk cartridge by getting engaged with the holding recess of the disk cartridge, thereby preventing the disk cartridge from being ejected out of the disk drive unintentionally due to the reactive force of the spring.

Patent Document No. 1: Japanese Patent No. 3030894

Patent Document No. 2: Japanese Patent Application Laid-Open Publication No. 2000-173223

## DISCLOSURE OF INVENTION

### PROBLEMS TO BE SOLVED BY THE INVENTION

[0011] However, the conventional disk cartridges have the following drawbacks.

[0012] In the disk cartridge disclosed in Patent Document No. 1, the engaging groove for guiding the shutter needs to be located outside the head window. In other words, the head window cannot be expanded beyond the engaging groove on the side surface. That is why the size of the record/reproduce head should be regulated so as not to interfere with the engaging groove structure of the disk cartridge even when the record/reproduce head is accessing the outermost portion of the disk. Nevertheless, to avoid regulating the size of the record/reproduce head, the distance from the outer periphery of the disk to the engaging groove should be increased, which would cause another problem because the disk cartridge would

have increased outer dimensions in that case.

[0013] On the other hand, in the disk cartridge disclosed in Patent Document No. 2, the holding recess is located on the bottom of the cartridge. That is why when the shutter is closed by the spring's force, the gripping member would easily disengage itself from the holding recess, thus possibly making it difficult to hold the disk cartridge firmly enough.

[0014] An object of the present invention is to provide a small-sized and highly dustproof disk cartridge by overcoming at least one of these problems of the prior art.

## MEANS FOR SOLVING THE PROBLEMS

[0015] A disk cartridge according to the present invention includes a case body, a shutter and an elastic member. The case body houses a disklike information storage medium in a rotatable position and includes: first and second side surfaces that extend parallel to an inserting direction, in which the disk cartridge is inserted into a disk drive for recording and/or reproducing information, and are opposed to

each other; a lower surface sandwiched between the first and second side surfaces; a head window, cut through a portion of the lower surface, for partially exposing the information storage medium; a shutter opening groove provided on the first side surface so as to extend in the inserting direction and to slide a shutter opener of the disk drive therein; and a holding recess provided at the bottom of the shutter opening groove. The shutter has an operating portion that protrudes into the shutter opening groove and opens or closes the head window by sliding parallel to the inserting direction. And the elastic member applies elastic force to the shutter so as to close the head window.

[0016] In one preferred embodiment, the head window has been cut open through the first side surface and the lower surface so as to reach the first side surface.

[0017] In this particular preferred embodiment, the head window has been cut open through the first side surface so as not to interfere with the shutter opening groove or the holding recess.

[0018] In a specific preferred embodiment, the head window

includes a side window that has been cut open through the first side surface and that is located closer to the lower surface than the shutter opening groove is.

[0019] In another preferred embodiment, the case body includes an upper half and a lower half, and the holding recess is defined by a rib of the lower half so as to form an integral part of the lower half.

[0020] In still another preferred embodiment, the case body has a holding notch that has been cut through the first side surface and the lower surface and another holding notch that has been cut through the second side surface and the lower surface.

[0021] In yet another preferred embodiment, the case body includes an elastic member sliding groove, which extends parallel to the shutter opening groove to have the elastic member slide therein, and a recess located at one end of the elastic member sliding groove. The elastic member sliding groove and the recess are both provided on the first side surface. While the head window is closed with the shutter portion, the elastic member engages with the recess, thereby

keeping the shutter portion locked and fixed.

[0022] In this particular preferred embodiment, the shutter includes a shield, which covers the head window, and an unlocking member including the operating portion. When the shutter opener contacts with the operating portion, the unlocking member disengages the elastic member from the recess and the shutter opener slides the shutter portion against the elastic force applied by the elastic member.

[0023] In yet another preferred embodiment, the case body includes a third side surface, which faces the disk drive when the disk cartridge is going to be inserted into the disk drive, and a fourth side surface opposed to the third side surface. The shutter opening groove reaches the third side surface so as to form an opening on the third side surface.

[0024] In yet another preferred embodiment, the disk cartridge further includes the disklike information storage medium with an information storage side. The information storage medium is housed in the case body such that the information storage side is partially seen through the head window when the shutter is opened.

[0025] In this particular preferred embodiment, the case body further includes an upper surface that is sandwiched between the first and second side surfaces and that is opposed to the lower surface. The holding recess is positioned at the bottom of the shutter opening groove so as to be located closer to the upper surface than the information storage side of the information storage medium is when the information storage medium has been loaded into the disk drive such that information is readily reproduced from, or recorded on, the medium.

[0026] In another preferred embodiment, the holding recess is positioned at the bottom of the shutter opening groove so as to be located in the upper part of a space between the upper and lower surfaces of the case body.

[0027] A disk drive according to the present invention includes: a chassis; a motor supported on the chassis and including a turntable; a head, supported on the chassis, for recording and/or reproducing information; and a holder having an insertion port for inserting the disk cartridge of one of claims 1 to 12 and a space for holding the disk cartridge.

The holder is rotatably secured to the chassis so as to take either a first position, at which the disk cartridge is insertable and removable through the insertion port without interfering with the turntable, or a second position, at which the information storage medium in the disk cartridge held in the space is mounted on the turntable. The disk drive further includes: a slider, which is arranged so as to slide with respect to the holder and which applies elastic force to the disk so as to eject the disk cartridge out of the holder through the insertion port; and a gripping member, which is connected to the slider so as to get engaged with the holding recess of the disk cartridge. The gripping member is arranged on the holder so as not to interfere with the head when the holder is turned to take the second position with no disk cartridge held.

**EFFECT OF THE INVENTION**

[0028] The disk cartridge of the present invention includes an elastic member that applies elastic force to the shutter in its closing direction. Thus, by keeping the head

window closed except when the head window should be opened, the dustproofness can be increased. In addition, since the holding recess is positioned in the shutter opening groove, the gripping member, which is provided for the disk drive to minimize the reactive force of the elastic member, will not disengage itself from the holding recess easily. What is more, interference between the gripping member and the lens actuator of a record/reproduce head can be avoided, too. As a result, a small-sized and highly dustproof disk cartridge can be provided.

## BRIEF DESCRIPTION OF DRAWINGS

[0029]

FIG. **1** is an exploded perspective view illustrating a preferred embodiment of a disk cartridge according to the present invention.

FIG. **2** is a perspective view illustrating how the disk cartridge shown in FIG. **1** looks when its shutter is closed.

FIG. **3** is a perspective view illustrating how the disk cartridge shown in FIG. **1** looks when its shutter is opened.

FIG. **4** is a perspective view illustrating the structure of a disk drive compatible with the disk cartridge shown in FIG. **1**.

FIG. **5A** is a plan view illustrating a state where the disk cartridge shown in FIG. **1** is going to be loaded into the disk drive shown in FIG. **4**.

FIG. **5B** is a plan view illustrating a state where the disk cartridge shown in FIG. **1** is going to be loaded into the disk drive shown in FIG. **4**.

FIG. **5C** is a plan view illustrating a state where the disk cartridge shown in FIG. **1** has been loaded into the disk drive shown in FIG. **4**.

FIG. **5D** is a plan view illustrating a state where the disk cartridge shown in FIG. **1** has been unloaded from the disk drive shown in FIG. **4**.

FIG. **6** is a plan view illustrating the position of the lower half in a situation where the disk cartridge shown in FIG. **1** has been loaded into the disk drive.

FIG. **7** shows a cross section of the overall disk cartridge as viewed on the plane **B-B** shown in FIG. **6**.

FIG. **8** shows a side view of the overall disk cartridge as viewed from the direction **C** shown in FIG. **6**.

## DESCRIPTION OF REFERENCE NUMERALS

[0030]

**1** upper half

**2** lower half

**3** information storage medium

**4** clamping plate

**5** shield

**6** stopper

**7** elastic member

**8** unlocking member

**10** case body

**11** shutter

**21** bottom window

**22** side window

**23** side rib

**24** shutter opening groove

**25** holding notch

**26** holding recess

**90** shutter opener

**100** head

**101** lens actuator

**102** objective lens

**110** gripping member

**111** gripping member at standby position

## BEST MODE FOR CARRYING OUT THE INVENTION

[0031] Hereinafter, preferred embodiments of a disk cartridge according to the present invention will be described. FIG. **1** is an exploded perspective view of a disk cartridge **51**. FIGS. **2** and **3** are perspective views illustrating how the disk cartridge **51** looks when its shutter is closed and when its shutter is opened, respectively.

[0032] The disk cartridge **51** includes a disklike information storage medium **3**, a case body **10**, a shutter **11**, and an elastic member **7**.

[0033] The information storage medium **3** includes a storage layer, from/on which information can be reproduced or recorded

by means of light or magnetism, for example. The storage layer may be either a write-once type or a rewritable type. Alternatively, the storage layer may even be a non-writable type on which data has already been stored. The size of the information storage medium **3** is not particularly limited, either. However, the present invention can be used particularly effectively to realize a disk cartridge that houses an information storage medium of a small diameter and that has small outer dimensions. The diameter of a preferred information storage medium **3** is about 80 mm or less.

[0034] The case body **10** includes an upper half **1** and a lower half **2** and houses the information storage medium **3** in a rotatable position. A clamping plate **4**, which is arranged around the center hole of the information storage medium **3** and is attracted to a turntable via magnetism, may form an integral part of the case body **10** such that the medium **3** can be mounted on the turntable firmly. As shown in these drawings, the case body **10** includes a first side surface **2a** and a second side surface **2b**, which extend parallel to an inserting direction **A** in which the disk cartridge is inserted

into a disk drive for recording and/or reproducing information and which are opposed to each other, and an upper surface **1a** and a lower surface **2c** sandwiched between the first and second side surfaces and opposed to each other. In this preferred embodiment, a third side surface **2d** that faces the disk drive when this disk cartridge is going to be inserted into the disk drive is a gently curved raised surface, while a fourth side surface **2e**, opposed to the third side surface **2d**, is a flat surface. In this manner, by making only the third side surface **2d** in a curved and raised shape, which is different from the others, the user can know the inserting direction of the disk cartridge **51** easily.

[0035] The case body **10** has a head window **12** for partially exposing the information storage medium **3** housed. Through this head window **12**, a head for recording and/or reproducing information accesses the information storage medium **3**. The head window **12** includes a bottom window **21** that has been cut through the lower surface **2c** and preferably further includes a side window **22** that has been cut through the first side surface **2a**. The bottom window **21** and the side window **22** are

continuous with each other. In other words, the head window **12** covers not only the lower surface **2c** but also the first side surface **2a**. The first side surface **2a** has a shutter opening groove **24** extending parallel to the inserting direction **A**. The shutter opening groove **24** reaches the third side surface **2d** so as to form an opening on the third side surface **2d**, too. A holding recess **26** is arranged at the bottom of the shutter opening groove **24** and near the third side surface **2d**.

[0036] If the case body **10** consists of the upper and lower halves **1** and **2**, any portion of the first and second side surfaces **2a** and **2b** may be defined by either of the upper and lower halves **1** and **2**. In this preferred embodiment, the bottom of the shutter opening groove **24** on the first side surface **2a** is defined by a side rib **23** of the lower half **2**. Thus, the holding recess **26** arranged at the bottom of the shutter opening groove **24** also forms an integral part of the lower half **2** continuously with the side rib **23**. By providing the holding recess **26**, the rib **23** and the upper half **1** can be bonded together in an increased area. As a result, the bond

strength between the upper and lower halves **1** and **2** can be increased.

[0037] Of the four side surfaces that form the holding recess **26**, a side surface **26d** that is perpendicular to the lower surface **2c** and located close to the third side surface **2d** is preferably perpendicular to the bottom of the shutter opening groove **24** such that the gripping member (to be described later) gets engaged with the holding recess **26** without fail. On the other hand, a side surface **26e** that is perpendicular to the lower surface **2c** and located close to the fourth side surface **2e** may be sloped so as to define an obtuse angle with respect to the bottom of the shutter opening groove **24**, for example. By providing such a sloped side surface **26e**, the internal space of the cartridge body **10** can be expanded.

[0038] The lower surface **2c** of the case body **10** has two positioning holes **29**. One of the two positioning holes **29** is adjacent to the third side surface **2d** of the case body **10** and the third side surface **2d** has an opening, too. This positioning hole **29** is used to set the disk cartridge **51** at a predetermined position in the disk drive by getting fitted

with a positioning pin provided for the disk drive. The third side surface **2d** that should face the disk drive when the disk cartridge is inserted into the disk drive also has an opening that is continuous with the positioning hole **29**. That is why into the positioning hole **29** adjacent to the third side surface **2d,** can the positioning pin be inserted through the opening on the side surface **2d.** Consequently, even when the disk drive adopts a structure that includes a holder rotating on a shaft provided at one end and that is designed to load the disk cartridge, inserted into the holder, into the disk drive by moving the holder up and down, the holder needs to be rotated just slightly to load and unload the disk cartridge **51.** As a result, the disk drive can have a reduced size.

[0039] Optionally, a holding notch **25** may be cut through both the lower surface **2c** and the first side surface **2a** of the case body **10** and another holding notch **25** may be cut through both the lower surface **2c** and the second side surface **2b** thereof. These holding notches **25** may be used in a disk drive with a consecutive loading type rack, which can house a number of disk cartridges therein, to get engaged with a changer for

automatically moving one of those disk cartridges after another from the rack to a recordable/playable position, or vice versa. Furthermore, a notch or a recess **30** may be cut through the second side surface **2b**.

[0040] On the first side surface **2a**, the side window **22** of the head window **12** is positioned closer to the lower surface **2c**. In order not to interfere with the side window **22**, the shutter opening groove **24** and the holding recess **26** are located over the side window **22** (i.e., closer to the upper surface **1a**) with the sidewall defining the shutter opening groove **24** interposed between them.

[0041] The first side surface **2a** also has an elastic member sliding groove **31**, which extends parallel to, and is continuous with, the shutter opening groove **24**. As will be described in detail later, one end of the elastic member **7** slides in the elastic member sliding groove **31**, thereby applying elastic force to a portion of the shutter **11**. There are recesses **27** and **28** at both ends of the elastic member sliding groove **31**. Specifically, the recess **28** is used to fix one end of the elastic member **7** thereon. When engaged with

the other end of the elastic member **7**, the other recess **27** prevents the elastic member **7** from stretching, thereby keeping the shutter **11** locked and fixed as will be described in detail later. When the other end of the elastic member **7** is not engaged with the recess **27** but rests on the bottom of the elastic member sliding groove **31**, the other end of the elastic member **7** moves in the elastic member sliding groove **31**.

[0042] The shutter **11** includes a shield **5** and an unlocking member **8**. Specifically, the shield **5** includes a bottom portion **5b** that covers the bottom window **21** of the head window **12**, a side portion **5a** that covers the side window **22** thereof, and an engaging portion **5e** arranged at the end of the side portion **5a** so as to be inserted into the shutter opening groove **24**. At both ends of the engaging portion **5e**, there are U-shaped holding portions **5d** with a rectangular bottom for holding the unlocking member **8**. The shield **5** further includes a contacting portion **5c** that has a rectangular notch and that is inserted into the shutter opening groove **24**.

[0043] The unlocking member **8** unlocks the shutter **11** that is closed with the elastic member **7**. For that purpose, the

unlocking member **8** has an operating portion **81** to contact with the shutter opener **90** of the disk drive and a contacting portion **82a** with a sloped notch at both ends thereof. The unlocking member **8** is inserted into the holding portions **5d** at both ends of the engaging portion **5e** of the shield **5**. And the unlocking member **8** and the engaging portion **5e** are inserted into the shutter opening groove **24**. The length **L1** of the engaging portion **5e** is shorter than the distance **L2** between the operating portion **81** and the contacting portion **82a** of the unlocking member **8**. The bottom portion **5b** of the shield **5** has one end pressed by a stopper **6** against the lower surface **2c** of the case body so as not to create a gap between the lower surface **2c** and itself.

[0044] Being guided by the unlocking member **8** and engaging portion **5e** that have been inserted into the shutter opening groove **24** and by the stopper **6**, the shutter **11** slides parallel to the inserting direction **A**. In this manner, the shutter **11** can take a position where it has closed the head window **12** and a position where it has opened the head window **12**.

[0045] The elastic member **7** contacts with the contacting

portion **82a** of the shutter **11**, thereby applying elastic force to the shutter **11** in the inserting direction **A** such that the shutter **11** closes the head window **12**. In this preferred embodiment, the elastic member **7** is a torsion spring. Alternatively, a spring of any other shape or a resin molded elastic member may also be used. The elastic member **7** has ends **71** and **72** and is deformed elastically. Even so, the elastic member **7** will soon restitute so as to maintain a predetermined distance between the ends **71** and **72**. The end **72** is inserted into the recess **28** of the elastic member sliding groove **31**. On the other hand, as long as the shutter **11** closes the head window **12**, the end **71** is engaged with the recess **27**, thus preventing the elastic member **7** from moving in the inserting direction **A** or in the opposite direction. While the shutter **11** is going to open, the end **71** slides on the bottom of the elastic member sliding groove **31**. As shown in FIG. **2**, while the shutter **11** is closed, the operating portion **81** of the unlocking member **8** is located closer to the fourth side surface **2e** than the holding recess **26** is inside the shutter opening groove **24**. In other words, the holding recess

**26** is located closer to the third side surface **2d** than the operating portion **81** of the unlocking member **8** is.

[0046] Hereinafter, it will be described how the shutter **11** operates. As shown in FIG. **2**, when the disk cartridge **51** is inserted into the disk drive in the inserting direction **A**, the shutter opener **90** is inserted through the opening of the third side surface **2d** into the shutter opening groove **24**. The shutter opener **90** is fixed in the disk drive. Therefore, as the disk cartridge **51** is inserted deeper, the shutter opener **90** relatively moves in the direction **D**, which is opposite to the inserting direction **A**, inside the shutter opening groove **24**. Then, the shutter opener **90** soon contacts with the operating portion **81** of the unlocking member **8** and presses the unlocking member **8** in the direction **D**. As described above, since the distance **L2** between the operating portion **81** and the contacting portion **82a** of the unlocking member **8** is greater than the length **L1** of the engaging portion **5e** of the shield **5**, only the unlocking member **8**, without the shield **5**, advances in the direction **D** at first. As a result, the end **71** of the elastic member **7** is inserted into the notch of the contacting

portion **82a**.

[0047] As the unlocking member **8** goes farther in the direction **D** due to the relative movement of the shutter opener **90**, the end **71** of the elastic member **7** soon makes a contact with the sloped portion of the notch. As a result, the end **71** is lifted from the recess **27** and moved onto the bottom of the elastic member sliding groove **31**. In this manner, the shutter is unlocked. As the unlocking member **8** goes even deeper in the direction **D**, the contacting portion **81** soon makes a contact with the holding portion **5d** of the engaging portion **5e** of the shield **5**. And due to the relative movement of the shutter opener **90**, the unlocking member **8** and the shield **5** are moved together in the direction **D**. In the meantime, the end **71** of the elastic member **8** moves on the bottom of the elastic member sliding groove **31**. That is to say, the shutter portion **11** begins opening the head window **12**.

[0048] Thereafter, as the disk cartridge **51** is inserted even deeper, the shutter opener **90** further moves relatively in the shutter opening groove **24** and the shield **5** goes farther in the direction **D**. Consequently, the head window **12** is fully

opened and the information storage medium **3** is exposed through the head window **12**.

[0049] When the disk cartridge **51** is fully inserted into the disk drive, the information storage medium **3** is mounted on the turntable of the disk drive. At this point in time, the shutter opener **90** is located at a predetermined position in the shutter opening groove **24** and the elastic member **8** prevents the shutter **11** from moving in the direction in which the shutter **11** closes the head window **12**. For that reason, as long as the disk drive is loaded with the disk cartridge **51**, the shutter **11** keeps the head window **12** open.

[0050] To unload the disk cartridge **51** from the disk drive by pressing an eject button, for example, an unloading mechanism (not shown) unloads the disk cartridge **51** in the opposite direction to the inserting direction **A**. Specifically, the shutter opener **90** relatively moves in the inserting direction **A** within the shutter opening groove **24**, and therefore, the end **71** of the elastic member **7** applies elastic force to the contacting portion **82a**, and eventually the shutter **11**, in the inserting direction **A**. That is to say,

the elastic member **7** applies the elastic force to the shutter **11** so as to close the head window **12**. When the shutter **11** reaches a position where the shutter **11** closes the head window **12** fully, the end **71** of the elastic member **7** is inserted into the recess **27** of the elastic member sliding groove **31**. As a result, the shutter **11** closes the head window **12** fully. Also, the shutter **11** is locked so as not to move and open the head window **12**.

[0051] If the user attempts to move only the shield **5** of the shutter **11** in the direction **D** manually, for example, then only the shield **5** will move in the direction **D** and the contacting portion **5c** at one end of the engaging portion **5e** of the shield **5** will contact with the end **71** of the elastic member **7**. This is because the distance **L2** between the operating portion **81** and the contacting portion **82a** of the unlocking member **8** is greater than the length **L1** of the engaging portion **5e** of the shield **5**. However, as the notch of the contacting portion **5c** is rectangular, the end **71** cannot be lifted from the recess **27** and cannot move in the direction **D** along with the shield **5**. That is to say, the shutter **11** is

kept locked by the end **71** of the elastic member and will not be unlocked easily. Besides, since the operating portion **81** of the unlocking member **8** is located inside the shutter opening groove **24**, it is also difficult for the user to open the shutter **11** by pressing the operating portion **81** with a finger, for example.

[0052] According to this preferred embodiment, the elastic member **7** applies elastic force to the shutter **11** such that the shutter **11** closes the head window **12**. Thus, by keeping the head window **12** closed except when the head window **12** should be opened, the dustproofness can be increased. For example, even if the disk cartridge **51** were dropped by mistake, it would be also possible to prevent the head window **12** from being opened accidentally due to the impact caused by the drop. In addition, by designing the unlocking member **8** such that the shutter is opened only when the contacting portion **81** of the unlocking member **8** is operated, it is also possible to prevent the user from opening the head window by operating the shutter either by mistake or on purpose.

[0053] Next, it will be described in detail how to load the

disk cartridge **51** into a disk drive. FIG. **4** illustrates an exemplary disk drive compatible with the disk cartridge **51**. This disk drive includes a chassis **201**, a cartridge holder **202**, and a spindle motor **205**.

[0054] The spindle motor **205** with a turntable is supported on the chassis **201**. Although not shown in FIG. **4**, a disk drive usually includes a record/reproduce head that is supported on the chassis **201**. On the chassis **201**, also arranged are positioning pins **201a** for positioning the disk cartridge **51** such that the information storage medium **3** in the disk cartridge **51** will be mounted on the turntable **5** of the spindle motor **205** appropriately. The chassis **201** is secured to the housing of the disk drive via a damper **208**, for example.

[0055] The holder **202** defines an insertion port **202b** for inserting the disk cartridge **51** and a disk cartridge holding space **202c**. A slider **203** is arranged on a side surface of the holder **202** and a spring **204** applies elastic force to the slider **203** in the opposite direction to the direction pointed by the arrow **A** (i.e., in the direction in which the disk

cartridge **51** is ejected from the insertion port **2b**). The slider **203** includes a contacting portion that contacts with the third side surface **2d** of the disk cartridge **51** that has been inserted into the holder **2**. Also, a gripping member **110** to get engaged with the holding recess **26** of the disk cartridge **51** is connected.

[0056] If the disk cartridge **51** is inserted through the insertion port **202b** into the space **202c** of the holder **202** in the direction pointed by the arrow **A**, the disk cartridge **51** soon contacts with the slider **203**. By pushing the disk cartridge **51** even deeper against the elastic force applied by the spring **204**, the disk cartridge **51** is further inserted and gets held on the holder **202**. At this point in time, the gripping member **110** gets engaged with the disk cartridge **51** as will be described later. When the disk cartridge is inserted fully, the slider **203** is locked to the holder **202** by a locking mechanism (not shown). As the disk cartridge is inserted deeper, the shutter of the disk cartridge is opened gradually.

[0057] The holder **202** is secured to the chassis **201** so as to turn around the axis **202a** of rotation. FIG. **4** illustrates

a position of the holder **202** where the disk cartridge **51** is readily insertable into, and removable from, the holder **202** through the insertion port **202b**. This position will be referred to herein as a "first position".

[0058] If the holder **202** including the disk cartridge **51** inserted is brought closer to the chassis **201**, the holder **202** soon reaches a position where the information storage medium **3** in the disk cartridge is mounted on the turntable of the spindle motor **5**. This position will be referred to herein as a "second position". At the second position, the information storage medium **3** starts rotating under the driving force of the spindle motor **5** and data can be reproduced from, or recorded on, the disk by using the head.

[0059] If the holder **202** is turned to go back from the second position to the first position, the slider **203** is unlocked and goes back to its rest position due to the elastic force applied by the spring **204**. As a result, the disk cartridge is ejected by a predetermined distance as measured from the insertion port **2b** and gets ready to be removed.

[0060] Hereinafter, the operations of inserting and

ejecting the disk cartridge **51** into/from the holder **202** will be described in further detail with reference to FIGS. **5A** through **5D**, which schematically illustrate the gripping member **110**, the slider **203**, the spring **204** and the shutter opener **90**. As described above, the gripping member **110** and the slider **203** are supported so as to be movable with respect to the holder **202** and are subjected to the elastic force applied by the spring **204** in the direction opposite to that pointed by the arrow **A**. On the other hand, the shutter opener **90** is fixed on the holder **202**.

[0061] As shown in FIG. **5A**, as the disk cartridge **51** is going to be inserted deeper into the holder **202** as pointed by the arrow **A**, the shutter opener **90** soon contacts with the operating portion **81** of the unlocking member **8** of the shutter **11**. If the disk cartridge **51** is inserted even deeper, then the unlocking member **8** that has contacted with the shutter opener **90** as described above unlocks the shutter that has been locked by the spring **7**.

[0062] Next, as the disk cartridge **51** is inserted even deeper into the holder **202** as pointed by the arrow **A**, the

unlocking member **8** and the shield **5** that have contacted with the shutter opener **90** remain at the same position but the body **10** of the disk cartridge **51** is inserted deeper into the holder **202**. As a result, the shutter **11** moves relatively in the direction opposite to that pointed by the arrow **A** as shown in FIG. **5B**. Then, the holding recess **26** of the cartridge body **10** gets engaged with the gripping member **110**. At this point in time, the slider **203** also contacts with the third side surface **2d** of the cartridge body **110**. That is why to insert the disk cartridge **51** even deeper into the holder **202** as pointed by the arrow **A**, the disk cartridge **51** needs to be pushed against the elastic force applied by the spring **204** that is connected to the slider **203**.

[0063] Subsequently, when the disk cartridge **51** is inserted fully into the holder **202**, the slider **203** will be locked to the holder **202** as shown in FIG. **5C**. As the disk cartridge **51** is going to be inserted, the shutter **11** of the disk cartridge **51** is opened gradually. In this state, the holder **202** is turned toward the chassis **201** to take the second position, where the information storage medium **3** in the disk cartridge

**51** is mounted on the turntable.

[0064] If the holder **202** is turned to go back from the second position to the first position again, the slider **203** is unlocked. Then, the slider **203** moves in the direction pointed by the arrow **D** under the elastic force applied by the spring **204**. As a result, the disk cartridge **501** is pushed out of the holder **202**. At this point in time, the elastic member **7** of the disk cartridge **51** pushes the unlocking member **8** of the shutter **11**. Thus, the shutter **11** does not move along with the cartridge body **10** of the disk cartridge **51** in the direction pointed by the arrow **D** but the unlocking member **8** keeps contact with the shutter opener **90**. That is to say, the unlocking member **8** moves relatively to the cartridge body **10** so as to close the shutter **11**. When the spring **204** connected to the slider **203** returns to its rest position, the slider **203** will stop moving. At that point in time, the front end of the disk cartridge **51** will be closer to the user by a distance **S** than that of the holder **202** is. In this manner, the unloading operation is finished. As described above, during the operations of loading and unloading the disk cartridge **51**, the

gripping member **110** also moves as the slider **203** moves.

[0065] Next, the position of the disk cartridge **51** in the disk drive will be described in detail. FIG. **6** is a plan view illustrating the position of the lower half of the disk cartridge **51** in the disk drive and FIG. **7** shows a cross section of the overall disk cartridge **51** as viewed on the plane **B-B** shown in FIG. **6**. In FIGS. **6** and **7**, the disk cartridge **51** has been loaded into the disk drive and the shield **5** has been opened fully. The head **100** is now located under the outermost zone of the information storage medium **3**. And a lens actuator **101** for getting focusing and tracking operations done by driving an objective lens **102** has been inserted into the head window **12**. The head window **12** has the side window **22**. That is why even the lens actuator **101** with big outer dimensions never gets stuck on the side window **22** or contacts or interferes with the case body **10**. Therefore, there are no size regulations on the lens actuator, and the disk cartridge **51** of the present invention can be loaded into even a disk drive with a big lens actuator.

[0066] Besides, as there is no longer any need to provide

an access space for the lens actuator between the side surface of the disk cartridge **51** and the information storage medium, the case body **10** of the disk cartridge **51** can have a reduced width as measured perpendicularly to the inserting direction **A**.

[0067] As can be seen, to avoid any contact or interference between the head **100** and the disk cartridge **51** in a situation where the disk cartridge **51** has been loaded into the disk drive, the side window **22** of the head window **12** preferably reaches the level **H1** that is as high as the information storage side **3a** of the information storage medium as measured from the lower surface **2a** when the information storage medium **3** is held so as to get information reproduced from or recorded on.

[0068] As described above, to load the disk cartridge **51** into the drive, first, the disk cartridge **51** is inserted into the holder **202** that has been raised to the first position, and then gets held by engaging the gripping member **110** with the holding recess **26** in the shutter opening groove **24**. After that, by turning the holder **202**, the overall disk cartridge **51**

is brought down with the gripping member **110** and fixed at a predetermined position using the positioning pins.

[0069] At that time, since the shutter **11** is opened as described above, the information storage medium is mounted on the turntable and the lens actuator of the record/reproduce head is inserted into the head window. The disk cartridge **51** in the descended state is positioned by the gripping member **110** and needs to be held properly so as to avoid contact with the turntable or the record/reproduce head. Since some gap is usually created between the upper and lower halves **1** and **2** that have been bonded together, the disk cartridge **51** can be held more appropriately by making the holding recess **26** form an integral part of the lower half **2** as is done in this preferred embodiment.

[0070] Meanwhile, to unload the disk cartridge **51** in such a state, the disk cartridge **51** is raised by turning the holder **202**. As a result, the slider **203** is unlocked to eject the disk cartridge **51** partially. At this point in time, to prevent the disk cartridge **51** from being popped out of the disk drive due to the reactive force of the elastic member **7**,

the gripping member **110** moves the disk cartridge **51** to the eject position while keeping engaged with the holding recess **26**.

[0071] FIG. **8** shows a side view of the overall disk cartridge **51** as viewed from the direction **C** shown in FIG. **6**. As shown in FIG. **8**, the gripping member **110** that has held the disk cartridge **51** thereon by engaging with the holding recess **26** raises the disk cartridge **51** once and moves to a standby position **111**, which is closer to the insertion port by the distance **S**, while the disk cartridge **51** is being ejected. Even after the disk cartridge **51** has been removed, the gripping member **110** stands by at that position. When the disk cartridge **51** is inserted next time, the gripping member **110** holds the disk cartridge again and returns to the position indicated by the solid lines.

[0072] In the vacant state in which no disk cartridge **51** has been inserted into the holder **202**, the holder **202** is brought down with the gripping member **110** still staying at the standby position **111**. However, the holding recess **26** is located at a higher level than the side window **22**. That is

why even if the standby position **111** is above the side opening **22** of the head window **12**, the gripping member **110** never interferes with the lens actuator **101** of the head **100**.

[0073] Suppose such an operation of the gripping member **110** were performed by a gripping member **120** to get engaged with a holding recess **25**, not the holding recess **26**. In that case, since the holding recess **25** would be located at the same level as the side window **22**, the standby position **121** of the gripping member **120** would enter the side window **22**. That is why when the record/reproduce head **100** is located around the outermost zone, the gripping member **121** might interfere with the lens actuator **101** in the vacant state in which no disk cartridge **51** has been inserted. According to the present invention, such an unwanted situation can be avoided.

[0074] To prevent the gripping member **110** from interfering with the head **100**, when the information storage medium **3** is held in the disk drive to have information reproduced from and/or recorded on it, the holding recess **26** is preferably located closer to the upper surface **1a** than the level **H1** of the information storage side **3a** of the information storage

medium **3** is. For that purpose, the shutter opening groove **24** is also preferably located closer to the upper surface **1a** than the level **H1** of the information storage side **3a** of the information storage medium **3** is as shown in FIG. **7**. Particularly, by arranging the holding recess **26** over the intermediate level **H2** between the upper and lower surfaces **1a** and **2a** of the case body (i.e., in the upper portion of the space between the upper and lower surfaces **1a** and **2a**), even when the vacant holder **202** is brought down, it is also possible to prevent the gripping member **110**, engaged with the holding recess **26**, from interfering with the head **100**.

[0075] As described above, according to this preferred embodiment, the gripping member that prevents the disk cartridge from being popped out due to the reactive force applied by the elastic member gets engaged with the holding recess in the shutter opening groove. Accordingly, even if the gripping member is lifted to a certain degree from the holding recess, the gripping member will still be located within the shutter opening groove and its position will be regulated by the shutter opening groove. That is why the

gripping member does not disengage itself from the holding recess easily and can prevent the unwanted movement of the disk cartridge without fail. Besides, no extra holding recesses have to be provided in addition to that located within the shutter opening groove, and the holding recess on a side surface of a small-sized disk cartridge can work efficiently. Furthermore, the head window is located closer to the lower surface than the shutter opening groove is, and is not continuous with the shutter opening groove. Consequently, the gripping member never enters the head window while the disk cartridge is being inserted or ejected.

[0076] In the preferred embodiment described above, the head window **12** is cut through only the back surface of the case body. Optionally, the upper surface of the case body may also have a head window.

[0077] In the preferred embodiment described above, a structure in which the elastic member locks the shutter is adopted. Optionally, another locking mechanism, as well as the elastic member, may be provided for the disk cartridge. Or the disk cartridge may have no locking mechanisms at all.

## INDUSTRIAL APPLICABILITY

[0078] According to the present invention, a small-sized and highly dustproof disk cartridge is provided. This disk cartridge is applicable to any of various disklike information storage media on which a write operation can be performed optically, magneto-optically or magnetically. The present invention can be used particularly effectively in a small-sized information storage medium with high storage capacity.